AIRPLANE COMMANDER'S MANUAL

III BOMBER COMMAND

SEPTEMBER 1944

AIRPLANE COMMANDER

COMPLETE YOUR MISSION

You are an Airplane Commander.

At this moment you are on a tense mission over well-defended enemy territory. Enemy fighters and flak harry your bomber. Suddenly, for a split second, something fails to click. For a split second something human or mechanical fails to carry its share of the load. For that fatal split second you are a sitting duck. Your mission is never completed.

Disaster might have been avoided. Something you could have done, perhaps weeks ago or months ago, might have enabled you, your airplane and your crew, to drop your bombs on the target and return safely to your home base.

This is your objective—drop your bombs on the target and return your crew and aircraft safely home.

IT'S YOUR BABY.

You are an Airplane Commander. As such, you are responsible for the completion of your mission, the safety of your plane and the lives and safety of your crew. The tiniest scrap of information about your plane or members of your crew, picked up on the long road of preparation, may be instrumental in bringing you back safely.

You, as Airplane Commander, have a command responsibility. That comes with your assignment. You are in the chain of command.

You have under your jurisdiction personnel who are trained as specialists. Valuable equipment is placed at your disposal for a designated purpose. Perhaps a half million dollars' worth.

You are not merely the pilot of the aircraft. Your duties and responsibilities go far beyond. Acting as pilot only, you actually would be in charge of your crew and utilizing your equipment for a relatively small percentage of the line. That is, merely when you're flying. But as Airplane Commander, you are responsible for your crew *AT ALL TIMES.*

KNOW YOUR MEN

Your ultimate object is to command as efficient and hard-hitting a unit as is humanly and mechanically possible. The path to such an objective may be long and winding and at times the footing may be ticklish, but the going will be well worth the trouble.

As Airplane Commander, you should know well every member of your crew. You should know the qualifications of each, his background in his specialty, his initiative and his interest in his duties.

And in addition:

Is he getting all the extra training necessary?
Are his quarters adequate?
Does he get to his meals at the proper time?
Does he get enough sleep?
Has he been paid up to date?
Does he have any unnecessary worries that may effect his training and duties?
Is he temperamental? cocky? nervous? or calm?

Practically speaking, there are few things that an Airplane Commander should not know about the daily life of his crew members. But, of course, there is a logical limit.

For instance, you don't have to know that last night your navigator tripped the light fantastic with Betty the blond bombshell from Bizerte or a phantom redhead from the Antipodes. But you should know the time


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of night he gets back from his date. He must have enough sleep before taking off on a navigation mission the following day.

Gain the confidence of your crew members. You are their father, their counsellor, their spokesman. Yes, maybe you are younger than some of the crew members but you are still the "old man" to them.

BY THE SWEAT OF YOUR BROW

You are running an organization. Your airplane and your crew constitute an organization just as much as the United States Steel Corporation, with the profit and loss registered in terms of life and death.

All right, you're the head of an organization, so the wisest thing you can do is act like a realistic Commander. You're the boss. You have a nice, cushy job. But you also have the responsibility of seeing that the various human and mechanical agencies under your control function as a unit. Every successful Commander—and that includes you—allocates duties to others and he insures that such duties are properly performed.

When the Airplane Commander knows what his crew and airplane should do and sees that each performs properly, then he commands an effective fighting unit.

To command means to work. The successful commander will work harder and longer than anyone subordinate to him. This is true no matter

how small the unit commanded may be. Your sweat will oil the cogs of your command.

In the cavalry, in making bivouac, horses are fed and watered first, then the men make camp and eat. Only when all this is accomplished and inspected, are the officers free to eat and rest.

The procedure should not differ greatly in the Air Corps. The plane should be properly parked and serviced, with precaution taken against inclement weather. Then quarters and rations should be obtained for the crew (particularly at strange fields). Then only should the Airplane Commander and officers be free to eat and relax.

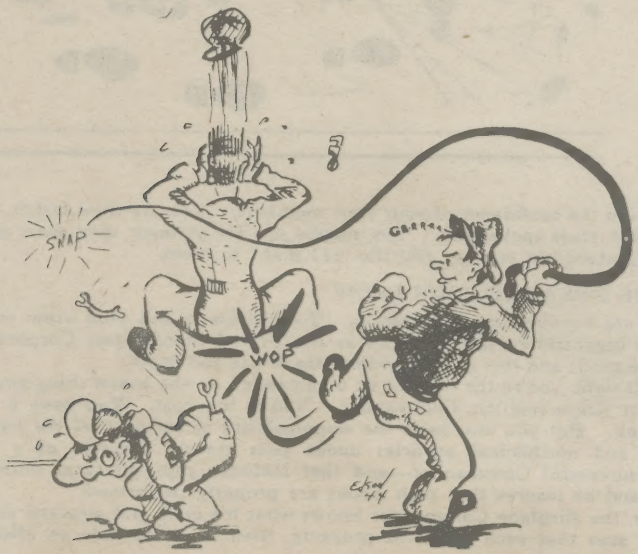
BULL SESSIONS

When the crew is first assigned, it's a good idea for the Airplane Commander to call the men together for a "bull session". Talk over your situation and your goal. But you, as Airplane Commander, must not hog the limelight. Let the others do most of the talking. Encourage ideas and free discussion by every member of the crew. In this first get together limit your own remarks to the minimum.

But be attentive, and you'll be able to size up the character of the men with whom you must work. Eventually, the lives of all your men may depend upon each.

Hold another "bull session" as soon after the first flight of the crew as a unit as practicable. And keep on holding them frequently during the training period. Later on in combat there will be no need to call them, they will be spontaneous.

Be ready to listen to complaints. You don't have to agree: in fact, it is your duty to point out fancied complaints and unwarranted griping. But be ready to listen. You'll learn more about the progress of the crew than by any other means.



Don't snap the bull whip in public. Guard against bawling out one of the crew in the presence of the others. If you have to reprimand a man, take him aside, point out his error or where he has been foolish or quick tempered. If you chew him out in front of others, you'll defeat your purpose by creating an antagonism.

Be considerate and fair, but don't let your crew run you. You are the *Commander.*

CHECK REQUIREMENTS

When a crew is first organized, the Airplane Commander should not take for granted that those assigned are physically and mentally qualified and suitable for their duties. Determine at once if the following requirements can be met by each individual, and start with yourself:

1. Are you, the Airplane Commander, ready to assume the responsibilities of leader, counsel for the crew, training instructor for the crew, and all the numerous other details that automatically fall upon the shoulders of the leader of the team?
2. Can each member of the crew perform all the duties his position in the combat team demands?
3. Has each member of the crew been assigned duties for which he is best suited?
4. Has each member of the crew qualified in aircraft recognition?
5. Does the crew work together as a team or are there clashes of personalities that cannot be overcome?

Now all these things may have been taken into consideration when the crew was assigned, but you, as Airplane Commander, are responsible for this group of men and they are the ones who some day, by proper performance of their duties will pull the airplane through a tough spot.

TUCK THEM IN

The combat crew is your family and upon you devolves the responsibility for its welfare, both in the air and on the ground.

See that the enlisted men are quartered together or in adjacent rooms. See that the men are paid when they should be paid, and that they have been issued all the clothing and equipment that they should have.

If you are away from your home station, make sure that the men are taken care of by arranging for quarters, meals, etc, even to the extent of financing them yourself, if necessary. You'll get your dough back later, but that's not the important thing.

The important thing is that, as Airplane Commander, you will be looked up to by the officers and men of the crew and they will expect you to help with all their problems. You cannot let them down.

Away from your home station you will have to make all plans and arrangements. And you must do these things before you consider yourself. It's a simple truth; you work for them and they'll work for you.

NO WEAK LINKS

In organizing your crew into an effective unit you will find your problems similar to those of the Squadron Commander organizing his squadron and the Group Commander organizing his group. Everyone in the army is an expert and everyone not only is a subordinate part of a unit but in some manner also commands.

Keeping in mind that a weak link may some day spell disaster, you, the Airplane Commander, will realize the importance of careful and detailed check-up on your crew training throughout your association together.

When you assume duty as Airplane Commander, it is necessary that you realize not only the importance of your role and your responsibility for the lives of the men who make up your crew, but also your own dependence upon these men and upon their faithful fulfillment of their assigned duties.

Once you understand your own responsibilities and the degree of efficiency you can expect from your crew members, then the big task is to knit these diverse individuals into a competent flying and fighting unit.

Suppose you find one or more of your crew members is not performing satisfactorily. Take the particular crew member aside and discuss the matter with him privately. Don't chew him out until you find out it is necessary. By reasoning discussion you may discover why there are shortcomings, and how to correct them.

PRAISE AND PUNISH IMPARTIALLY

Don't forget to give a man a pat on the back when he does a good job, and look for things to praise as well as to criticize. Criticize the crew members' mistakes promptly, but privately. Commend the men publicly. Praise is more productive than censure.

Strive for a maximum of efficiency and contentment and a minimum of punishment. It is useless to punish a man who has done his best. Punish carelessness, but remember that the only objective of punishment is to prevent repetition, and not to satisfy personal grievances.

Unfair treatment breeds ill-will. Be on the level. *Praise and punish the crew impartially..*

If this is not satisfactory, discuss the matter with the technical instructor of the recalcitrant crew member. Together you may decide that some special coaching is required. Then make the necessary arrangements right away.

If you are in doubt as to which instructor to confer with, go to the squadron staff officer in charge of that crew member's specialty; that is, the Squadron Gunnery, Communications, Bombing or Navigation Officer.

Only after you have used every means at your disposal to remedy the situation and have failed, should you report the matter to the Flight or Squadron Commander.

DISCIPLINE

Discipline is one of the problems of the Airplane Commander. The best method of instruction in discipline still is by example.

For instance, if the Airplane Commander addresses his subordinates by their proper military titles, such as Corporal, Sergeant, or Lieutenant, they in turn will show the same respect for him.

In the airplane you should adhere to the standard system of interphone communication. If you, as pilot, set the standard and abide by it, you will have no difficulty in making your crew do likewise.

The Airplane Commander must never lie to any member of the crew.

Truth is the greatest builder of trust, respect and confidence. Every promise made must be fulfilled. Every order given must be enforced.

The Airplane Commander must never permit his own ill-humor to enter into a relationship with the crew. Never be contemptuous. If you make a mistake, guard against blaming the crew or being sarcastic.

The crew must never be ignored. You should take a personal interest in the welfare of each crew member. But, of all things, avoid intimacy with them. Familiarity breeds contempt and social disagreements often carry over to duty. There is no better way to promote efficiency and to maintain esprit de corps than to observe a certain amount of formality.

This is your job as Airplane Commander. If you do it well and properly, you will be rewarded by the knowledge and experience that in times of emergency you have the unquestioning obedience of every member of the crew. A crew whose Commander does not maintain normal military discipline ceases to be a crew—a team—and becomes a disorganized group of individuals.

YOU WON'T KID ANYBODY

If you are fortunate enough to have crew members who have had more practical experience in certain lines than yourself, invite their advice and counsel. The crew can quickly determine how little or how much the Airplane Commander knows, and it will respect the man who recognizes his own limitations.

Every effort must be expended to instill a sense of duty, pride and a strong feeling of mutual obligation and confidence among the crew.

When dissension occurs, first ascertain whether it is not yourself who is in the wrong. Then make every effort to establish friendly relations, but in case this is impossible, don't be afraid to request the proper authority to have the trouble-maker removed from the crew.

The rule to follow is:

1. Find out who is at fault.
2. Make every effort to establish harmony.
3. If all efforts fail, seek authority to have trouble-maker replaced.

The Flight Commander, Squadron Operations Officer and Squadron Commander should be consulted before a man is replaced. Perhaps their additional experience and knowledge can be utilized to salvage the dissenter.

Only in the case of complete incompetence or uselessness should you attempt to get rid of one of your crew members. Consider the availability of replacements before ousting a man. Remember, it reflects upon you if

you cannot make your crew a team; but don't hesitate if one man's incompetence jeopardizes your outfit.

KNOW YOUR AIRPLANE

To demand the respect and confidence of your crew, you must know your airplane well. It is a complex machine made up of engines, metal, hydraulics, electronics, fuel lines, etc. You need not know each part precisely because you have specialists in your crew, but you should know enough about each instrument and each control to properly direct your crew.

For instance, don't tell your radio operator to tune the VHF; it has happened and you can imagine what the crew thought.

Study your airplane and equipment well and don't be afraid to get instructions from your own crew as well as from technical instructors. In this way your crew members will get that feeling of pride in showing you what they know.

Can you work a turret? Can you tune a radio set? Do you know where all the emergency controls and equipment are? Can you tell if a gun is loaded correctly? Can you check your airplane from nose to tail and tell if any little thing is wrong?

If you can do these things, you will have the confidence of your crew. But if you can't, you'd better start learning.

DETAILED RESPONSIBILITIES

Now to consider the detailed responsibilities of the Airplane Commander. You, as Commander, must be expert in your ability to fly your assigned

airplane, but you need not be an expert in the other combat jobs necessary to make an airplane a combat weapon.

So far as the Navigator, Bombardier, Engineer, Radio Operator and Gunners are concerned, you, as Airplane Commander, need only know what each of these experts should be able to accomplish, and in a general way, you must know the means avaialble for this accomplishment.

You need not know more about engines than the Engineer, nor more about the bombsight than the Bombardier, nor more about octants than the Navigator. The specific knowledge required by each member of a bomber crew is taught him by competent and experienced instructors. You have the right to expect that this instruction will enable each man to fill his place on the combat crew.

The Airplane Commander must have an intelligent understanding of the standards which the crew members can attain. Moreover, he must realize the limitations of the equipment provided the crew in fulfilling its function.

In other words, you, as Airplane Commander, need not be able to strip a .50-caliber machine gun with gloves on, nor should you expect your gunners to be able to hit enemy planes a thousand yards away. But you should require that your gunners strip a .50-caliber machine gun with gloves on at high altitude and you should know that 600 yards is the correct range to open fire on an enemy plane.

EMERGENCY!

You are returning from a mission. You've bombed your objective—right on the nose. You've waded through enemy fighters and flak and now you're headed home. Your plane has been hit a couple of times, but nothing serious. You feel pretty good; your crew is in excellent spirits.

Suddenly, it happens. Maybe it's a fire, or a motor conks out, or any one of a number of things that might occur. Your plane loses altitude. You have a quick decision to make. Put out the fire, order the crew to bail out, attempt a crash landing, or, if you're over water, try to ditch.

Whatever the decision, whatever the emergency, you must KNOW that all members of your crew will do the proper thing. You must KNOW that all the proper equipment is aboard for any emergency.

This is a time when fast-action, smooth-functioning teamwork counts heavily. You must KNOW that your men will be in the right places, doing the right things at the right time. Your decision to ditch, to crash, or whatever, must be based upon that knowledge.

It is your responsibility, as Airplane Commander, to know that your men are trained for any emergency. To crash, to ditch, to bail out—anything. The best way to assure yourself of that is through ground practice drills. You must drill, drill, drill, until you and your crew work like a clock.

Know the proper procedure for bailing out, crashing, ditching; know the use of emergency equipment, and be sure your crew also has this knowledge.

More than that, it is your responsibility, before taking off on a mission, to be sure all emergency equipment functions properly and that you have all you need in the airplane. Pay particular attention to carbon dioxide cartridges on the life raft and Mae West, water containers, Very pistols, emergency radio, and other signal devices.

Test the escape hatches. Know—don't hope—that they will operate if the need arises.

Check and recheck life vests, parachutes, first aid equipment and be absolutely sure that you and each member of your crew know how to use them.

If your crew and your airplane operate under all these conditions, the odds on your returning home safely will be greatly enhanced. Come hell or high water, you'll get back.

Breaking it down simply, your ultimate goal, as Airplane Commander, is three-fold:

1. Get the plane over the target.
2. Provide a steady and true platform from which the Bombardier can drop his eggs on a dime.
3. Get your plane and your crew home safely.

In order to command the most efficient and hard-hitting combat team you must have some knowledge of the function and duties of each member of your crew, as well as his capabilities. You must know what each man should be able to do and what he can do. You don't have to know how to do these things yourself but you must understand what to expect of each man.

What you must know about the functions of each crew position is dealt with on the subsequent pages, as follows:

1. Knowledge of Flying
2. Knowledge of Engineering
3. Knowledge of Co-pilot's duties
4. Knowledge of Navigator's duties
5. Knowledge of Bombardier's duties
6. Knowledge of radio
7 Knowledge of gunnery

I. KNOWLEDGE OF FLYING

First of all, what do you know about your particular job as Pilot? What must you know and be able to do to fly and command the type of airplane to which you have been assigned? (See Pilot's Information File.)

YOU MUST

1. Know the operational characteristics of the airplane assigned.
2. Be able to take off and land in approximately the minimum distance listed for your type airplane.
3. Be qualified to take off under zero-zero conditions; take-offs using flare paths under blackout conditions.
4. Be qualified to fly under actual instrument conditions with and without radio aids.
5. Be qualified to fly a bombing run, even under combat conditions, so precisely that the Bombardier will have only the solution of the bombing problem and not the additional burden of out-guessing an erratic Pilot.
6. Be qualified to fly the airplane as a navigational platform that will allow the Navigator to perform with precision the navigational technique necessary for the successful accomplishment of combat missions.
7. Be qualified in formation flying for all types of tactical formations.
8. Be proficient in methods of evasive action at varied altitudes and operating speeds, in and out of formation but keep in mind that evasive action on the bombing run has caused the Bombardier to miss more targets than any one thing and that if you miss today you have to return tomorrow and fly through the same FLAK again.
9. Be qualified to fly and properly operate your aircraft on extended missions.
10. Be able properly to navigate and locate your position by pilotage, radio aids, or simple dead reckoning, or by a combination of these methods.
11. Have thorough knowledge of all safety regulations:
    a. Applicable to assigned airplane.
    b. Airways flying.
    c. Ordinary flying.
12. Have thorough knowledge of all emergency procedures:
    a. Bail-out procedure.
    b. Ditching procedure.
    c. Lost plane procedure.
    d. Distress procedure.

13. Know weather.

You can never know too much about weather. The ocean of air through which you must guide your plane is always a vital challenge to your knowledge and ability. Although great strides have been made in practical knowledge of upper air conditions, many weather phenomena still are mysteries to men who have spent their lives studying meteorology.

Always keep a weather eye peeled during flight. On the ground strive to increase your knowledge of the causes and effects of weather phenomena. That is invariably the practice of the best pilots, the old pilots. Those who are heedless or ignorant of weather do not have the chance to grow old.

Specifically, you, as Airplane Commander, should be thoroughly familiar with T. O. 30-100D-1 and TM 232. Always look to increase your knowledge and understanding of the medium through which you fly. You must know the air as a sailor knows the sea, and then some.

II. KNOWLEDGE OF ENGINEERING

What you, as Airplane Commander, should understand about Engineering.

1. *Airplane:*

a. General knowledge of airplane's construction and maintenance.

b. Detailed knowledge of:
   (1) Operation of controls.
   (2) Weight distribution and the effect on flying characteristics.
   (3) Hydraulic system: brakes, landing gear, flaps.
      (a) Emergency procedures for operation of landing gear, flaps and brakes.
   (4) Correct operation of automatic pilot and general working knowledge of this instrument.

2. *Engines:*
   a. General knowledge of engine construction, operation and maintenance.
   b. Detailed knowledge of:
      (1) Engine operating limits, and correct operating settings for take-off, climb, cruising, glide and landing.
      (2) Operation of all controls to engines.
      (3) Allowable minimum, maximum and optimum instrument readings.
      (4) Electrical system.
      (5) Fuel system.
      (6) Fuel consumption data.
      (7) Propeller feathering system and correct use of engine.

   (8) Knowledge of procedure governing use of wing and prop deicing systems.

3. *Inspections and Forms:*
   a. What and when inspections are necessary and what they cover.
   b. Be able to perform a pre-flight and daily inspection.
   c. Be familiar with forms which give information on the mechanical condition of the airplane.
      (1) Form 1A.
      (2) Form 41A and 41B.

4. Appreciate and fully understand your relation to the ground crew.

Primarily you must be precise in your report on the operational failures of the airplane. You must personally check the Form 1 to be sure that all available information has been included in the report.

Confer personally with the crew chief. Discuss what occurred in the air. Give your diagnosis and help your crew chief by giving a complete picture of the exact details of malfunction. Bear in mind that the crew chief has not been along on the flight and must work on the information which you and others relay to him.

Be tactful. Don't curse or chew out the ground crew, no matter how much it will relieve your feelings. Actually, such tactics will get you nowhere. The ground crew has a pretty thankless task. If everything goes well, the men on the ground seldom hear about it. But if anything goes wrong, they always catch hell. If the ground crew has been negligent and the matter cannot be handled otherwise report this condition to the Squadron C. O. or other proper authority.

Be considerate. Compliment the men on the ground for good work, help them correct malfunctions with full information, and you will find that their efficiency will increase considerably. They'll be pulling for you.

Furthermore, it will do no harm for you to put on overalls occasionally and work with the ground crew. The knowledge you will acquire and the respect you will gain will compensate you well for the time thus spent.

III. KNOWLEDGE OF CO-PILOT'S DUTIES

The Co-pilot is your assistant and is a potential First Pilot and Airplane Commander. He should be familiar enough with all your duties so that he can assist properly and, if necessary, take over for you.

Keep this in mind and instruct your Co-pilot so that he will be of maximum assistance and so that he will be qualified to take over your duties when necessary.

The Co-pilot usually will be the Engineering Officer for the airplane and will maintain a complete log of performance data for the aircraft. You should insure that your Co-pilot is proficient in the following:

1. Properly operate the engines under all conditions.
2. Be able to take-off and land in a slightly longer distance than the minimum listed for the type of airplane assigned.
3. Be qualified to fly as Pilot of the airplane when the Pilot is present in the right seat, day or night.
4. Be able to hold any assigned formation position, day or night.
5. Be qualified in instrument flying.
6. Be qualified to navigate during daylight and darkness by pilotage and and dead reckoning and radio aids available.
7. Be proficient in making bombing approaches both by the use of PDI and interphone.
8. Be qualified to operate properly all radio equipment located in the cockpit.

IV. KNOWLEDGE OF NAVIGATOR'S DUTIES

1. The Navigator is charged with duty of guiding the airplane to the target and back home; he must know the geographical position of the airplane at all times.

a. Whenever Pilot asks, "Where are we?" the Navigator should be able to answer, "Sir, at 0915 we were at latitude so and so," or "Sir, in six minutes we will be over Lake City."

b. Geographical position of the airplane should be entered in the Navigator's log at least every 30 minutes.

c. It is up to you, as Airplane Commander, to keep in mind that the Navigator is the recorder or secretary for the flight. Everything that happens or is observed on the mission should be included in his log.

d. All the crew members should report periodically to the Navigator the status of observable weather about the airplane and any ground observations pertinent to the flight.

e. The correctness, completeness and punctuality of the Navigator in keeping a proper log of the mission is one of the best means you, as Airplane Commander, have of determining the efficiency of the Navigator.

2. The calibration and alignment of the navigational instruments of the airplane is the responsibility of the Navigator.

a. You must remember that the Navigator's problem is rendered more complicated whenever there is a change in compass reading, air speed or altitude of the airplane, even if the changes are quite small.

b. Standards of good navigation assume that for each hour of flight an error of two minutes in ETA is permissible and for each 60 miles of flight an error of one mile is permissible. That is, two minutes per hour and one degree off course.

c. From these standards you can understand that if you fly carelessly, say two degrees off course, the Navigator will be unable to perform his duties satisfactorily.

3. You must see that the Navigator has an opportunity to practice the various methods of navigation—pilotage, dead-reckoning, radio and celestial.

a. At the same time the Navigator is practicing, you should also get in some navigational training. Have a set of sectional maps in the cockpit and when the Navigator is performing celestial or DR, follow the track of the airplane by pilotage navigation.

b. When doing this, don't ask the Navigator, "What is that town on our right?", or "What is that river we are flying over?". You'll only confuse him. The Navigator, working on a Mercator chart, cannot answer these questions without referring to a sectional map.

c. Instead, ask for a position report and then compare the latitude and longitude given by the Navigator with the pilotage position which you have determined.

4. At least a half an hour before take-off confer with the Navigator on the destination of the flight and the track to be followed. This enables the Navigator to compute the required courses and distances, and to check the weather and winds at various altitudes along the planed track and draw the proper maps and charts.

5. By checking the Navigator's performance, and flying straight and level, you and the Navigator will constitute a team capable of flying accurately to any spot on earth within the range of your aircraft.

V. KNOWLEDGE OF BOMBARDIER'S DUTIES

What you, as Airplane Commander, should know about the duties of the Bombardier.

1. *Theory of Bombing:*
   a. General knowledge of a Bombardier's equipment, its operation and its limitations.
   b. Type of approach (bombing run) required for accurate bombing.
2. *Bombs and Fuzes:*
   a. Types of bombs best suited for the targets to be hit.
   b. Types of fuzes most effective to be used on the targets to be hit.
3. *Safety Factors:*
   a. The safe altitudes for dropping various types and weights of bombs to be used with instantaneous fuzes.
   b. How to arm bombs, how to make them "safe" and how to drop them "safe" in emergencies.

The Bombardier's primary job is to hit the target. From the very beginning, when the airplane was first sketched on the drawing board, when the personnel of the crews were first taken into the Army and throughout all the long phases of the training of each individual and the crew, the ultimate objective is this final duty of the Bombardier—to hit the target. For him to accomplish this, the other members of the crew have to do their share of the teamwork required. But their duties well done will not make the Bombardier hit the target. They will only assist him.

There have been many occasions when an airplane has passed over the target at the end of its bombing run with no bombs dropped. There have been times when a second run was made, subjecting the airplane and crew to unnecessary danger, and still no bombs dropped. On such occasions the airplane and crew would have saved time and fuel by staying at home. They would not have futilely subjected the airplane to possible damage and loss.

Most of these malfunctions are easily traced back to improper Pilot-Bombardier teamwork or to some cause that could have been avoided by proper maintenance and checking.

Under any given set of conditions—ground speed, altitude, direction, etc. —there is only one point in space from which a bomb may be released from the airplane to hit a pre-determined object on the ground. Know, then, that if the Bombardier is to release his bombs correctly, he must understand the following:

1. He must know and understand his bombsight, what it does for him and how it does it.
2. He must thoroughly understand the operation and upkeep of his bombing instruments and equipment.
3. He must know that his racks, switches, controls, releases, doors, linkage, etc., are in first class condition at all times.
4. He must know how to operate all gun positions in the airplane.
5. He must know how to load, clear simple stoppages and jams, and do air trouble-shooting on aircraft machine guns.
6. He must be able to load and fuze his own bombs.
7. He must understand the destructive power of bombs and must know the vulnerable spot on various types of targets.
8. He must understand the bombing problem, bombing probabilities, bombing errors, etc.
9. He must be versed thoroughly in target identification and camouflage, and in aircraft identification.

For the Bombardier to be able to do his job, you, the Pilot, must place the airplane in the proper position to arrive at a point on a circle about the target from which the bombs can be released to hit the target.

VI. KNOWLEDGE OF RADIO

1. You must know the capabilities and limitations of all radio equipment aboard your airplane. You should know the approximate power output ratings of each type transmitter, maximum working range of transmitters to be expected under normal conditions, and frequency ranges of each set to enable you to utilize this equipment to the best advantage. You must know how to operate the command set, radio compass, VHF set, IFF set, and the dinghy transmitter.

2. You must have a thorough knowledge of the following procedures:
   a. Combined R-T procedure.
   b. VHF-DF procedure.
   c. Instrument landing.
   d. Standard beam approach and controlled approach.

e. Airways flying.
f. Pilot's advisory service.

3. *Relationship with Radio operator:* You must make every effort to ascertain the ability of your radio operator. Radio operators should be qualified to perform these duties:

a. Send and receive 18 words per minute in International Morse Code.
b. Send and receive 10 words per minute in blinker.
c. Perform first echelon maintenance on all aircraft radio equipment (replace tubes, fuzes, antennae, etc.).
d. Possess a thorough operating knowledge of all radio equipment in the airplane.
e. Be proficient in the use of all procedures pertinent to communications.
f. Be drilled in security measures—safeguarding and proper handling of classified material and radio discipline.

4. *Security measures:* You, as Airplane Commander, are responsible for the safeguarding and proper handling of classified material aboard your aircraft. You must thoroughly familiarize yourself with the precautionary steps to be taken when such material is carried on your airplane.

5. *Summary:* The employment of radar has led to many innovations in the radio field. This means constant study on your part to keep abreast of latest developments. Indifference in this respect might mean the difference between success or failure of your mission.

VII. KNOWLEDGE OF GUNNERY

A bombardment airplane's defensive abilities largely determine its offensive capabilities. Therefore it is your vital responsibility to understand what constitutes aerial gunnery proficiency. You will be sure of an efficient combat team when you satisfy yourself that your gunners know and can do these things:

1. Weapons:
   a. Strip, clean, reassemble, adjust, time, install, harmonize, load, and operate caliber .50 machine guns efficiently under combat conditions.
   b. Demonstrate ability to recognize and correct malfunctions under combat conditions of altitude.
2. Other equipment:
   a. Manipulate primary and secondary gun or turret positions proficiently and be capable of accomplishing minor repairs on these positions.
   b. Mount, adjust, harmonize, and perform minor repairs on gun sights mounted at assigned positions; have thorough knowledge of the sight's potentialities and limitations.
   c. Operate auxiliary equipment, such as interphone, oxygen, flares, according to approved methods, etc., and be able to perform all additional duties efficiently.
3. Procedure:
   a. Properly employ sighting and arming equipment at assigned positions.
   b. Be able to determine the mil value of ring sights and apply 70 mil principle for the purpose of range estimation.
   c. Apply Position Firing and Burst Control principles on sighting and aiming.
   d. Perform the duties of sector guarding and be familiar with the clock system of reporting position of attacking aircraft.
   e. Recognize enemy and friendly aircraft quickly and accurately and be familiar with the wing span class of all enemy operational fighter type aircraft and the approved method of estimating range.
   f. Perform required emergency procedures swiftly and surely.

CHECK LIST OR REMINDERS FOR THE AIRPLANE COMMANDER

1. Know each crew member's name and background.
2. Read and study the Pilot's Information File.
3. Read the operational manual appropriate to the airplane assigned.
4. Keep a daily journal.
5. Know the status of training of each crew member at all times.
6. Encourage crew members to look for work which will enhance on-the-job training.
7. Conduct competitions of efficiency (such as stripping guns, etc.).
8. See that the crew has proper living, eating, sleeping, and recreational facilities.
9. Is the crew punctual and obedient?
10. Call meetings so that the crew members can get together and discuss their problems.
11. Is the crew working together or is there a trouble-maker who requires disciplinary action.
12. Praise good work, avoid sarcasm.
13. Guard against familiarity with the crew members.
14. Be sympathetic and prepared to advise and counsel the crew members on both military and personal subjects.
15. Be fair, investigate thoroughly before turning any problem over to higher authority.
16. Can the crew members perform their duties properly?
    a. Do they need training in theory and classroom work?
    b. Do they need practice?
    c. Do they need aerial instruction?
17. Be military, courteous and neat. Set the proper example and see that the crew follows it.